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JOURNAL OF THE INSTITUTE OF PETROLEUM

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THE INSTITUTE OF PETROLEUM

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PROF. A. W. NASH, M.Sc.

PRESIDENT, 1939–1942.

DIED, MARCH 14TH, 1942.

[*To face p. 83.*

UNIV. OF MICH.

TWENTY-EIGHTH ANNUAL REPORT.

1941.

THE Twenty-Eighth Annual Report of the Council, covering the activities of the Institute during 1941, is presented for the information of the members.

MEMBERSHIP.

The changes in membership recorded during 1941 are summarized in the Table below :—

	Total Dec. 31, 1940.	CHANGES DURING 1941.					Total Dec. 31, 1941.
		New.	Transferred to.	Deceased.	Resigned.	Transferred from.	
Hon. Members	17	—	—	1	—	—	16
Fellows	410	10	—	6	6	—	408
Members	502	13	2	1	9	—	507
Assoc. Members	537	21	10	2	15	2	549
Students	136	26	—	—	—	10	152
Totals	1602	70	12	10	30	12	1632

At the present time such a Table can only be regarded as approximate. The fate of more than 200 members in enemy-occupied countries and the Far East is unknown, though their names are retained on the roll of the Institute. It is satisfactory to note that the number of new entrants during 1941 was only six less than in 1940.

The Council has to record with deep regret the decease of the following members during 1941 :—

	Date elected.	Class of membership.
CADMAN, The Rt. Hon. Lord	1913	Fellow
CARPENTER, J. A.	1925	Fellow
EDELEANU, Dr. L.	1925	Hon. Member
ELLIS, C.	1933	Fellow
✠HOLLOWAY, G. L.	1933	Assoc. Member
HOWARD, F. E.	1920	Fellow
HOWE, W. H.	1928	Fellow
MACNAB, W.	1913	Member
WARD, P. J.	1936	Fellow
✠Woolgar, C. W.	1936	Assoc. Member

✠ Killed while serving with the R.A.F.

HONOURS.

His Majesty The King has conferred the following honours upon members of the Institute during 1941.

Baron : F. J. Leathers, Esq., was created a Baron and assumed the title of Baron Leathers of Purfleet. Lord Leathers was appointed to the new post of Minister of War Transport in May, 1941.

Knight Grand Cross of the Order of the Bath : Sir Frank E. Smith, F.R.S.

Distinguished Flying Cross : Flying-Officer R. A. Chisholm.

MEETINGS.

Seven meetings were held in London during 1941 and one (a joint meeting with the Society of Chemical Industry) in Birmingham. A list of papers presented is given below :—

Date, 1941.	Subject of Paper.	Authors.
5th Feb.	"Addition Agents for Lubricating Oils."	E. A. Evans and J. S. Elliott.
11th March.	"Octane Rating Relationships." (Read by Dr. A. E. Dunstan.)	G. Egloff and P. M. van Arsdell.
18th March.	"Soil Classification."	A. H. D. Markwick.
	"Bitumen in Soil Stabilization."	H. Gardiner.
1st May.	"Petroleum as a Raw Material."	A. W. Nash.
10th June.	"Hydrocarbon Solvents."	F. N. Harrap and E. B. Evans.
8th July.	"Oils for Cable Impregnation."	J. C. Wood-Mallock.
12th Aug.	"Asphaltic Bitumen in War-time." (Informal Discussion.)	A. W. Jarman.
17th Oct.	"Cyclization of Hydrocarbons." (Joint Meeting with S.C.I.)	S. W. Green and A. W. Nash.

The thanks of the Council are tendered to the Institute of Mechanical Engineers and the Royal Society of Arts for the loan of meeting-rooms.

An Institute Luncheon was held on 1st May. The President presided over a gathering of about 220 members and guests. Among those present were Mr. Geoffrey Lloyd, M.P., Sir Frank E. Smith, G.B.E., F.R.S., Sir Henry T. Tizard, K.C.B., F.R.S., and Dr. R. E. Priestley, M.A.

Publication.

Some reduction in the volume of the Institute's publications was inevitable in 1941 owing to the scarcity of contributions and the rationing of paper supplies. The *Journal* (Vol. 27) was therefore issued in ten parts, no publication being made in August or September. The Abstracts of technical literature have been well maintained though fewer in number than in recent years. In view of the difficulty experienced by many members in obtaining periodicals from abroad, a longer synopsis than was formerly the practice has been given whenever the importance of the original justified it.

Vol. 6 of the *Annual Reviews of Petroleum Technology* (covering 1940) was published in October and distributed in a paper-covered edition in lieu of the August and September *Journals*.

The voluntary submission of all publications of the Institute to the Ministry of Information for censorship continued in force throughout the year.

Information Services and Library.

The Institute has continued to render all possible assistance to Government departments in the supply of technical information, and has been consulted by the Admiralty, the War Office, the Air Ministry and the Ministry of Supply. The Institute's technical committees co-operate closely with the Ministry of Aircraft Production and the Petroleum Department, and include representatives of both Departments.

The postal lending service of the library has been well used, particularly the system of linking-up the *Journal* abstracts with the original papers available on loan. Binding of periodicals has been kept up to date.

The thanks of the Council are accorded to authors, publishers, and others who have kindly presented books to the library; to the executors of the late Dr. V. Henny, who presented to the Institute a large number of reference and text-books from his personal library; and to the Institution of Mechanical Engineers, the Royal School of Mines and the Science Library for their courtesy in allowing members the facilities of their libraries.

Chemical Standardization.

The type and greater part of the stock of the 3rd (1935) edition of *Standard Methods for Testing Petroleum* were destroyed by enemy action in May, 1941. A new edition was put in hand almost immediately by the Chemical Standardization Committee. This will incorporate various changes planned before the war, including considerable revision of some of the methods in the 3rd edition and several new methods. The following Reports were published in the *Journal*:—

"Calibration of C.F.R. Reference Fuels," May 1941, p. 192.
"Distillation of Liquid Asphaltic Bitumen (Tentative)," June 1941, p. 226.
"Calibration of Tetraethyl Lead in C.12," June 1941, p. 230.
"Report on Coefficients of Expansion of Crude Petroleum, by Sub-Committee J," Nov. 1941, p. 402.

Finance.

The audited accounts for the year, the Balance Sheet at 31st December, 1941, the accounts of the Benevolent Fund, and the list of contributors to the latter are given in the following pages.

Both income and expenditure are on a lower scale than in pre-war years. A net surplus of income over expenditure amounting to £210 14*s.* 1*d.* has been transferred to the Balance Sheet. During the year £1025 was invested in Savings Bonds, £75 deposited in the Post Office Savings Bank on Institute Account, and £150 invested in Defence Bonds on Benevolent Fund account. The total investments in Government securities and in the Post Office Savings Bank at 31st December, 1941, amounted to £6583, or approximately 70 per cent. of the total investment. As further funds become available they will be invested in Government securities.

The protracted negotiations over the Institute's offices at the Adelphi, requisitioned by the Ministry of Works in 1939, were concluded in November. A settlement was finally agreed for compensation at the rate of £1000 per annum, exclusive of rates. Arrears of compensation received and adjustments for rent have resulted in an addition of £514 1*s.* 0*d.* to the War Contingencies Reserve shown on the Balance Sheet.

The Council again expresses its thanks to the University of Birmingham and the Department of Oil Engineering and Refining for the provision of office facilities; also to the Council of the Institution of Chemical Engineers for the loan of rooms at 56 Victoria Street for the holding of Council and Committee meetings.

Awards.

The following awards were made :—

Scholarship of £40, tenable at the Royal School of Mines : E. B. Turner.
Students' Medal and Prize : J. G. Perks (Birmingham University).
Students' Prize : F. W. Longbottom (Birmingham University).
Burgess Prizes : A. K. Davies and V. D. Daft (Birmingham University).

Council and Officers.

It is with deep regret that we have to record the death of Professor A. W. Nash on 14th March, 1942, whilst serving as President of the Institute—an office he had held since 1939. His lovable personality and sound judgment will be greatly missed in the counsels of the Institute.

Mr. C. Dalley, M.I.E.E., F.Inst.Pet., has been elected by the Council to be President of the Institute for the year 1942–43.

Messrs. Ashley Carter, C. Dalley, F. H. Garner, J. McConnell Sanders and F. B. Thole were elected Vice-Presidents; and Messrs. R. Crichton, A. F. Dabell, V. C. Illing, E. R. Redgrove and W. J. Wilson were elected members of Council at the Annual General Meeting.

Six meetings of the Council and ten meetings of Committees of the Council were held during 1941.

Staff.

Miss B. M. H. Tripp left the staff in January 1942 to take up an appointment with the British Council.

Acknowledgments.

The Council records its appreciation of the services to the Institute of the Rt. Hon. Lord Plender, G.B.E., Honorary Treasurer; Messrs. Price Waterhouse & Co., Auditors; Messrs. Ashurst, Morris, Crisp & Co., Solicitors; the Midland Bank, Ltd., Selly Oak, Birmingham; and the members of the Staff.

Approved for publication on behalf of the Council of the Institute.

Christopher Dalley, President.
Arthur W. Eastlake, Ashley Carter } Joint Honorary Secretaries.
S. J. Astbury, Secretary.

7th May, 1942.

THE INSTITUTE

REVENUE ACCOUNT FOR THE

	£ s. d.	£ s. d.	1940 £
To **Administration Expenses :—**			
Staff Salaries	1650 4 9		1515
Printing and Stationery	164 19 7		182
General Postages	169 16 1		165
Telephone, Cables, and Telegrams	8 15 0		6
		1993 15 5	
„ **Establishment Charges :—**			
Rent, Rates, etc.	338 2 2		330
Cleaning and Lighting	34 9 6		33
Repairs and Renewals	5 18 6		7
		378 10 2	
„ **Publications :—**			
Journal Expenses	1313 13 5		1416
Abstractors' Fees	243 4 6		246
Postage on Journals	167 10 5		190
Cost of Other Publications	442 7 7		454
		2166 15 11	
„ **Meetings :—**			
Hire of Hall, Pre-prints, Reporting		171 2 2	119
„ **Professional Fees :—**			
Legal Expenses	28 0 3		50
Auditor's Fee	42 0 0		42
		70 0 3	
„ **Students' Scholarships and Prizes**		87 7 0	89
„ **Library Expenditure**		34 11 9	45
„ **Branches and Sections :—**			
Students Section	14 15 0		
Trinidad Branch	20 0 0		
		34 15 0	55
„ **Sundry Expenses**		196 10 9	150
„ **War Damage Contribution and War Risks Insurance**		76 10 0	—
„ **Donation to R.A.F. Benevolent Fund**		105 0 0	—
„ *Transfer to War Contingencies Reserve*		—	1250
„ **Balance, being Surplus for Year, carried to Balance Sheet**		210 14 1	121
		£5525 12 6	£6814

RESEARCH FUND INCOME AND EXPENDITURE

	£ s. d.
To **Grant Made During Year :—**	
British Electrical and Allied Industries Research Association	15 0 0
„ **Balance as at 31st December, 1941**	137 17 10
	£152 17 10

OF PETROLEUM

YEAR ENDED 31ST DECEMBER, 1941

	£ s. d.	£ s. d.	1940 £
By **Subscriptions for 1941 received** . .		3199 8 6	3583
" **Special Subscription**		20 0 0	20
" **Subscriptions in Arrear, received during year**		130 7 0	72
" **Publications**		1928 19 4	2400
" **Interest and Dividends (Gross)** . .		246 17 8	238
" *Grant in Aid of Rent*		—	500
" Compensation Received from Ministry of Works and Buildings for 1941 . .	1000 0 0		
Add Grant in Aid of Rent . . .	692 10 7		
	1692 10 7		
Less Rent payable to the Adelphi for 1941 .	1692 10 7		
		£5525 12 6	£6814

ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1941.

	£ s. d.
By **Balance as at 31st December, 1940**	142 16 1
" **Interest Received During Year**	10 1 9
	£152 17 10

THE INSTITUTE

(A Company limited by Guarantee

BALANCE SHEET AS

	£ s. d.	£ s. d.
Capital of the Institute under Bye-Law, Section 6, Paragraphs 14 and 15 :—		
Life Membership Fund—	£ s. d.	
As at 31st December, 1940 . . .	817 14 0	
Additions during year	2 0 0	
	819 14 0	
Entrance and Transfer Fees—		
As at 31st December, 1940 . .	3642 12 9	
Additions during year—		
Entrance Fees	69 16 0	
Transfer Fees	2 2 0	
	3714 10 9	
Profit on Sale of Investments—		
As at 31st December, 1940	351 10 11	
Donations—		
As at 31st December, 1940	326 5 0	
		5212 0 8
Research Fund		137 17 10
T. C. J. Burgess Prize Fund :—		
As at 31st December, 1940	10 0 0	
Less Awards during year	5 0 0	
		5 0 0
War Contingencies Reserve :—		
As at 31st December, 1940	1250 0 0	
Add Surplus on settlement of rent and compensation (1939–40) in respect of Adelphi premises . .	514 1 0	
		1764 1 0
Members' Subscriptions Received in Advance .		87 13 6
Journal Subscriptions Received in Advance . .		224 0 5
Sundry Creditors, General Account . . .		1265 16 2
World Petroleum Congress		223 15 4
Revenue Account :—		
Balance as at 31st December, 1940	2524 9 1	
Add Surplus for year as per separate statement . .	210 14 1	
		2735 13 2
		£11,655 8 1

C. DALLEY, President.
ARTHUR W. EASTLAKE
ASHLEY CARTER } Joint Honorary Secretaries.

AUDITORS'

We report to the Members of THE INSTITUTE OF PETROLEUM that we have obtained all the information and explanations we have required. We are of the correct view of the state of the Institute's affairs as at 31st December, 1941, according the books of the Institute.

CAVENDISH HOUSE,
41, WATERLOO STREET, Birmingham, 2.
4th May, 1942.

OF PETROLEUM.

and not having a Share Capital.)

AT 31ST DECEMBER, 1941.

	£ s. d.	£ s. d.
Investments :—		
On Account of Capital, at cost—		
£461 12 0 3% Conversion Stock, 1948/53 . .	491 12 6	
664 6 6 3% London County Consolidated Stock, 1920	481 10 6	
806 8 3 3% Manchester Corporation Redeemable Consolidated Stock, 1958 . . .	845 17 7	
867 8 6 2¾% Bristol Corporation Redeemable Stock, 1955/65	845 17 7	
150 0 0 5% Wandsworth and District Gas Co. Debenture Stock	154 8 6	
400 0 0 3% Metropolitan Water Board "A" Stock, 1963	346 10 7	
125 0 0 5% Great Western Railway Co. Consolidated Preference Stock . . .	105 4 9	
150 0 0 3% Luton Corporation Redeemable Stock, 1958	151 6 7	
150 0 0 3% Smethwick Corporation Redeemable Stock, 1956/58	151 4 9	
600 0 0 3% Bristol Corporation Redeemable Stock, 1958/63	597 7 3	
500 0 0 3% Defence Bonds	500 0 0	
525 0 0 3% Savings Bonds	525 0 0	
	5196 0 7	
(Market Value at 31st December, 1941, £5303 10*s.* 0*d.*)		
Cash awaiting Investment on Deposit with Post Office Savings Bank	16 0 1	
		5212 0 8
On Account of Revenue, at cost—		
£790 8 3 3% Conversion Stock, 1948/53 . .	842 8 0	
500 0 0 3% Defence Bonds	500 0 0	
		1342 8 0
(Market Value at 31st December, 1941, £1311 3*s.* 1*d.*)		
On Account of Research Fund, at cost—		
£336 5 10 3% Conversion Stock, 1948/53 . .		357 14 8
(Market Value at 31st December, 1941, £345 0*s.* 10*d.*)		
Office and Library Furniture (excluding Presentations) :—		
As at 31st December, 1940		1 0 0
Library Books (excluding Presentations) :—		
As at 31st December, 1940		—
Subscriptions in Arrear :—		
Not Valued		—
Sundry Debtors, less Reserve for Doubtful Debts .		421 16 4
Cash at Bank on Current Account and in Hand .		1320 1 7
Cash on Deposit with Post Office Savings Bank :—		
General Account	2776 11 6	
World Petroleum Congress Account . . .	223 15 4	
		3000 6 10
		£11,655 8 1

REPORT.

examined the above Balance Sheet with the books of the Institute and have opinion that such Balance Sheet is properly drawn up so as to exhibit a true and to the best of our information and the explanations given to us, and as shown by

PRICE, WATERHOUSE & Co.,
Chartered Accountants.

BENEVOLENT FUND.

RECEIPTS AND PAYMENTS ACCOUNT FOR YEAR ENDED 31ST DECEMBER, 1941.

RECEIPTS.

	£ s. d.	£ s. d.
Balance on 1st January, 1941		815 5 2
Receipts during 1941 :—		
Subscriptions	50 1 6	
Donations	99 0 2	
Interest	15 13 6	
Income Tax recovered	7 13 0	
		172 8 2
		£987 13 4

PAYMENTS.

Benevolent Fund :—		
Grants in Aid		60 0 0
Balance on 31st December, 1941 *		927 13 4
		£987 13 4

* The Balance on 31st December, 1941, was held as follows :—

	£ s. d.
Cash in hand	12 0
Cash at Bank on Current Account	48 4 4
3% Defence Bonds	350 0 0
£600 0 0 3% Local Loans at cost †	528 17 0
	£927 13 4

† (Market Value at 31st December, 1941, £574 10*s.* 0*d.*)

We have examined the above Receipts and Payments Account with the books and vouchers of the Fund and find it to be in accordance therewith. We have verified the Investments and the Balances with Bankers comprising the Balance on 31st December, 1941.

CAVENDISH HOUSE, 41, WATERLOO STREET, BIRMINGHAM, 2.

PRICE, WATERHOUSE & Co.
4th May, 1942.

A. E. DUNSTAN, Chairman, Benevolent Fund Committee.
CHRISTOPHER DALLEY, President.

LIST OF DONORS AND SUBSCRIBERS DURING 1941.

Adams, A. C.
Allcard, H. G.
Auld, S. J. M.
Austin, J. M.
Backhouse, S. R.
Baylis, A. N.
Bell, O. A.
Blakiston, J. H.
Bolton, R. P.
Bowrey, S. E.
Bressey, R. J.
Brodie, N. M.
Brown, C. B.
Brown, R. G.
Burwell, A. W.
Bushe, L. A.
Cameron, I.
Castle, A. F.
Chadwick, A.
Charlton, H. E.
Chrisman, A. R.
Clapp, F. G.
Clement, L.
Cole, F. A. J.
Cox, A. W.
Coxon, G. H.
Crichton, R.
Dalley, C.
Darley, H. C. H.
Davson, C. W.
Dewhurst, J. D.
Downs, W. W.
Duck, A. E.
Dunkley, G. W.
Dunstan, A. E.
Edeleanu, I.
Ellis, J.
Evans, A.
Evans, R. J.
Everist, G. E.
Farrant, V. M.
Farthing, V. L.
Fay, E.
de Ferembre, R. G.
Fletcher, H. D.
Fox, D. A.
von Fuchs, G. H.
Garner, F. H.
Gent, E. L.
de Golyer, E.
Gottesmann, M.
Gray, W.
Griffiths, P. M.
Hall, F. C.
Hall, J. H.
Heaton, W. B.
Henderson, W. R. S.
Henson, F. R. S.
Hersch, L. H.
Hirst, W. P.
Hotham, E.
Howard, G. P. E.
Hubbard, W. A.
Hunter, F. E.
Hunting, E. A.
James, J. E.
Jameson, J.
Jennings, J. C.
Jones, H. F.
Kenyon, H.
Knights, J. W.
Kidd, T. G.
Kugler, H. G.
Lavington, H. V.
Lee, C. A.
Le Mesurier, L. J.
Macarthur, H.
McCreath, T. T.
McCue, C. F.
McCullum, I.
Mackilligan, R. S.
Macniven, H. B.
Martin, J. W.
Maskell, L. O.
Masters, J. S. S.
Mayo, F.
Mayo, H. T.
Mitchell, R. G.
Moon, C. A.
Moore, L. F.
Nash, A. W.
Owen, R. M. S.
Perks, A. J.
Porter, P. N. D.
Pracey, H. E. F.
Preston, R.
Purves, A. R.
Redgrove, E. R.
Reid, H. W.
Richard, A. H.
Richards, G. A.
Robathan, T.
Roger, A.
Ruthven-Murray, A. J.
Sams, C. E. R.
Scott, G. H.
Scott, L. D.
Scott, T. R.
Smallwood, W.
Southwell, C. A. P.
Spielmann, P.
Stevens, L. C.
Tait, E. J. M.
Taitt, G. S.
Taylor, J. F. M.
Templeton, J. C.
Thornley, G. H.
Tijmstra, S.
Tullet, G. V.
Tweed, R. R.
Underwood, A. J. V.
de Waele, J. P. A.
Walker, L. H. T.
Walsh, D. M.
Walter, G.
Watling, R. A.
Webb, J. F. N.
Westbury, J.
Wigney, W. J.
Wilkes, A. C. R.
Wood, C. W.
Young, R. H.
Staff of Shell Central Laboratories.

TRINIDAD BRANCH.

REPORT OF THE COMMITTEE ON THE WORKING OF THE BRANCH DURING THE SESSION 1940–41.

FIVE meetings were held during the Session, at which the following papers were read :—

1941	
29th January.	*13th Annual General Meeting.* "Notes on the Sealing Effect of Fault Surfaces," by G. STEWART TAITT.
30th April.	*64th General Meeting.* "Countercurrent Flow," by D. GORDON BAGG.
8th May	*65th General Meeting.* "The Oil Industry and the War Effort," by DR. G. EGLOFF.
28th May	*66th General Meeting.* "Hardening Times for Casing Cementation," by N. HEALEY and S. L. PEASE.
27th June	*67th General Meeting.* "Well Completion Methods in Trinidad," by P. E. T. O'CONNOR.

Mr. L. A. Bushe was elected Chairman, and Mr. A. F. Castle Hon. Secretary and Treasurer.

The average attendance of members and guests at meetings was forty-four, but it was brought up to this high figure by the large attendance at Dr. Egloff's lecture, otherwise the figure would have been twenty-two, compared with twenty-five for the previous year.

There were seventy-eight members on the roll at the end of the year, compared with seventy-three for the previous year.

On account of the War, the Annual Dinner was not held.

The sum of $103.00 was contributed to the Benevolent Fund by members of the Branch and forwarded to the parent body. The sum contributed the previous year was $67.90.

An extract from a letter from the Secretary of the parent body states :—

"The Committee has always appreciated the substantial help for the Fund which comes from the Trinidad Branch. Once again I have to thank you for the generosity of the members."

A revised List of Members resident in Trinidad was made and issued during the Session.

The parent body wrote requesting the Branch to accept half the usual Annual Grant—*i.e.*, £20 instead of £40—owing to the need for conserving resources during the war. In view of the satisfactory financial condition of the Branch, the Committee willingly agreed.

Great difficulty was experienced by the Committee in securing papers by members to be read before the Branch, and the thanks of the Committee are due to those members who gave much time and effort towards keeping the Branch in a live and useful state.

TRINIDAD BRANCH.

Balance Sheet as at 31st October, 1941.

Liabilities.			Assets.	
Subscriptions to Benevolent Fund :			Cash at Bank	$431.49
As per last Balance Sheet	$140.80		Cash in hand	2.69
Received during the year	130.40			
	271.20			
Remitted to London during year	256.30			
To be remitted to London		$14.90		
Income and Expenditure Account :				
As at 31st October, 1940	439.92			
Excess Expenditure over Income for year ended 31st October, 1941	20.64			
		419.28		
		$434.18		$434.18

Income and Expenditure Account for Year Ended 31st October, 1941.

Expenditure.			Income.	
Filing Cabinet	$11.86		Grant from Institute of Petroleum, London	$48.00
Clerical assistance	25.00		Excess Expenditure over Income	20.64
Stationery, etc.	17.98			
Postages	11.16			
Telephone	2.64			
		$68.64		
		$68.64		$68.64

(*Signed*) L. A. Bushe, *Chairman.*

A. F. Castle, *Hon. Sec. and Treasurer.*

F. E. Hunter, H. A. Harris } *Auditors.*

Minutes of 14th Annual General Meeting, held at Apex Clubhouse on 26th November, 1941.

Mr. L. A. Bushe in the Chair.

1. The Acting Hon. Secretary read the Minutes of the 13th Annual General Meeting, and their confirmation, being proposed by M. J. D. Fullerton, and seconded by Mr. J. Burslem, was carried unanimously.

The Minutes of the 67th Ordinary General Meeting, at which the Auditors for the current year had been elected, were also read, their confirmation being proposed by Mr. H. W. Reid, seconded by Mr. G. S. Taitt, and carried unanimously.

2. The accounts for the year having been circulated, the Chairman pointed out that expenditure exceeded income by $20.64, but that the parent body owed them $48 for the year. They had written to the parent body suggesting that the Trinidad Branch might vote some of the funds received from the parent body to some war charity; but the parent body had thought they might accept a smaller grant, to which the Committee had agreed, and the grant was cut in half, being now $96 a year. They had received $48, and had therefore $48 to come, which would give them something in the neighbourhood of $20 income over expenditure for the year.

The adoption of the Accounts for the year was proposed by Mr. H. C. H. Thomas, seconded by Mr. F. H. L. Tindall, and carried unanimously.

3. The Committee's Report on the working of the Branch for the year 1940–41 was read. The Chairman observed that with regard to the list of members, apparently it did not agree with the parent body's list, and the Secretary would be glad if anyone who had any amendment to make would advise him. Some members might think that apologies were due to them because they had not received notices of papers or meetings, but this was entirely due to the fact that their list of members was apparently not complete. There were some members who were really members of the parent body, but whose names they had not received, and, conversely, there were some whose membership had ceased, but whose names were still on the list.

The "hardy annual" question again came up about the difficulty of obtaining papers, and he was sure the new Chairman would be very pleased to hear from any gentleman who would like to read a paper during the coming year.

The adoption of the Committee's Report was proposed by Commander H. V. Lavington, seconded by Mr. G. H. Scott, and carried unanimously.

4. *Election of Officers.*—The Chairman said it was not necessary to hold a ballot, as there were two retiring members of the Committee and two new names had been received—namely Mr. L. K. White, who had already served on the Committee previously for some years, and Mr. F. W. Penny, who had served the Institute for many years in Roumania.

The thanks of the Committee were due to the retiring members, Messrs. F. H. L. Tindall and C. C. Wilson.

Mr. G. H. Scott had also been nominated, but asked to have his name withdrawn, and thus obviate the necessity of holding a ballot at the meeting.

The new Committee was therefore: Messrs. L. K. White, F. W. Penny, H. W. Reid, A. F. Castle, H. C. H. Thomas, and L. A. Bushe.

5. *Auditors.*—A vote of thanks to the retiring Auditors, Messrs. H. A. Harris and F. E. Hunter, was proposed by Mr. H. C. H. Thomas, seconded by Mr. G. H. Scott, and carried unanimously.

There being no other business, the meeting terminated at 9 p.m.

ANNUAL GENERAL MEETING.

Friday, 29th May, 1942.

The Twenty-ninth Annual General Meeting of the Institute was held at the Connaught Rooms, London, W.C.2, on Friday, 29th May, 1942. There were fifty members of the Institute present.

At the commencement of the Meeting, Dr. A. E. Dunstan, Past President, occupied the Chair.

Dr. Dunstan said that he had two duties to perform, one a sad one and the other a very pleasant one. From the earliest days of the Institute it had been the custom for the retiring President to introduce his successor. On the present occasion their retiring President was no longer with them. Professor Nash had died in March, after occupying the Presidential Chair for nearly three years. They had lost a man whom they all loved, one who had been a personal friend for more than twenty years. He was a man in the prime of life, and they were all saddened by his untimely death. As this was the first meeting of the Institute to be held after Professor Nash's decease, he would ask the members to stand for a few moments in silent tribute.

(*The members then stood in silence.*)

Continuing, Dr. Dunstan said it was appropriate that he should have the privilege of inducting their new President, both as the senior Past President present and as Mr. Dalley's oldest friend.

Induction of Mr. C. Dalley.

Dr. Dunstan had known Mr. Dalley for more than twenty-five years. Mr. Dalley's connection with the Institute went back to its early days. He had been trained as an electrical engineer, and his early work was concerned with the installation of large generating plants in electric traction schemes, including the electrification of the L.C.C. tramways and London's underground railways.

Mr. Dalley had subsequently specialized in the application of electricity to the industries of coal, iron and steel, and petroleum. He had been chief engineer to the Anglo-Persian Oil Company during its great development period of 1914–1926. In 1926 he had left the Company to become joint managing director of Trinidad Petroleum Development Co., Ltd. Dr. Dunstan believed that Mr. Dalley was the first engineer to install on a large scale high-lift centrifugal pumps in pipe-line boosting-stations operating in series. One pump delivered oil into the suction of the next pump many miles distant, and so on. He was also one of the first to utilize in refinery practice the principle of pass-out or reducing turbines for the economic and simultaneous production of high-pressure and low-pressure steam and electricity.

All this was typical of Mr. Dalley. He had always been a pioneer. He had pushed new ideas, and was never content with the *status quo*. Dr.

Dunstan well remembered a day when, as a humble chemist, he had evolved a new reaction. Like all chemists, he had done his experiments in a test-tube, which, after shaking for so long, allowed the reaction to proceed to completion. He had put the suggestion up to Mr. Dalley, whose comment had been: "All right. How long do I shake this up in a 20,000-gallon washer?" That was typical of the man, always taking the broad, practical point of view.

Finally, DR. DUNSTAN could not omit to say a word about the personal qualities of their new President. Many of the members present knew him well, as the genial, hard-working President of the Oil Industries Club. Mr. Dalley was a good mixer, what their American friends called a "good scout." It was fitting that they should have as their President one who was both a man of affairs, an eminent engineer, and a good fellow. He had the greatest pleasure in asking Mr. Dalley to take the Presidential chair. (*Applause.*)

MR. DALLEY then took the Chair.

Replying MR. DALLEY said that he wished to thank the members for the honour they had done him, as well as Dr. Dunstan for his very flattering remarks. In electing him President they had set him a difficult task in having to follow such a long line of distinguished men. But he would do his best to see that their confidence had not been misplaced.

MR. DALLEY very much regretted that he had to ask them to excuse him on this first occasion, as he was at present under the doctor's orders. He would have to leave the meeting in the capable hands of his old friend Dr. Dunstan.

DR. A. E. DUNSTAN then resumed the Chair.

The Secretary, MR. S. J. ASTBURY, read the notice convening the meeting and the report of the Auditors. The Minutes of the Twenty-eighth Annual General Meeting were read and signed.

NEW MEMBERS.

It was agreed that the list of Fellows, Members, Associate Members, and Students elected and transferred during 1941 be laid on the table.

ELECTION OF MEMBERS OF COUNCIL.

On the proposal of MR. VINEALL, seconded by MR. WARD it was unanimously agreed that the following members of Council, retiring and offering themselves for re-election, be duly elected members of Council: Messrs. E. A. EVANS, J. S. JACKSON, H. C. TETT, and A. WADE.

In reply to a question, the Chairman stated that Dr. Wade was at present in Australia.

ANNUAL REPORT.

The Chairman then moved:—

"That the Annual Report of the Council for the year 1941, together with the Accounts and Balance Sheet as at 31st December, 1941, be and are hereby adopted.

MR. ASHLEY CARTER, seconding the motion, said that income and expenditure were now both about 75 per cent. of their pre-war level. He would

like to direct attention to the fact that the assets of the Institute were, at the end of 1941, over £10,000, the highest they had been in the history of the Institute.

Other features of the accounts were dealt with in the Report. The long negotiations over the Adelphi had reached a settlement of sorts at the end of 1941, but he hoped that recent legislation would enable the Institute to be relieved altogether of its liabilities for the Adelphi premises. He was pleased to report that arrangements had been made for an early return of the Institute's offices to London.

The Chairman then put the motion to the meeting, and it was carried unanimously.

Election of a Joint Honorary Secretary.

Referring to the occasion as a very pleasant one in the history of the Institute, the Chairman said that their friend Mr. Ashley Carter, who had from the first been a tower of strength in their deliberations, was now put forward as a Joint Honorary Secretary of the Institute.

Mr. T. Dewhurst, formally proposing the election of Mr. Carter, said that Mr. Carter's qualifications for the post were so obvious, indeed so striking, and his election was so desirable, that it was with much pleasure he commended the proposal for unanimous acceptance.

Col. S. J. M. Auld, seconding the proposal, said that the Institute was extremely fortunate in having secured the services of this most estimable man and this most loyal supporter of the Institute's activities.

The motion was unanimously adopted.

Mr. Ashley Carter, in responding, said that a word of explanation was necessary. Since the inception of the Institute, Mr. Arthur W. Eastlake, long associated with their first President, Sir Boverton Redwood, had been their Honorary Secretary. The years were now telling on Mr. Eastlake's health and, unfortunately, he was no longer able to attend the meetings of the Institute, nor the meetings of the Council and committees. It was felt that it might be advisable to appoint somebody to be a joint honorary secretary with Mr. Eastlake. There was no intention that his position should be usurped, and no implication that he no longer retained his interest in the Institute. It was simply that someone, acting jointly with Mr. Eastlake, should be able to attend the meetings. Therefore, in thanking the members for the honour they were conferring upon him, Mr. Carter said he was assuming its responsibilities in the earnest hope he would carry them out to their satisfaction. (*Applause.*)

Appointment of Auditors.

On the proposal of Mr. G. J. C. Vineall, seconded by Mr. R. J. Ward, it was unanimously agreed that Messrs. Price, Waterhouse & Co., be re-elected auditors for the ensuing year.

There being no further business, the proceedings of the Annual General Meeting then terminated, and the Chairman declared the meeting closed.

OBITUARY.

ALFRED WILLIAM NASH.

It is with the deepest regret that we have to announce the death of Professor A. W. Nash, whilst holding office as President of the Institute. He died peacefully in his home at Solihull, Warwickshire, on Saturday, 14th March, in his fifty-sixth year.

Born in 1886 at Ongar, Essex, he was educated at the East London Technical College. After serving an apprenticeship with Messrs. Hunter & English he became Assistant Engineer at Chatham Dockyard. In 1906 he joined the Staff of the Taikoo Dockyard and Engineering Company in Hong Kong as Engineer, going from there to the Port of London Authority in 1908. A year later he went to Persia as Fields Engineer and Surveyor for the Anglo-Persian Oil Company, Ltd. During this period he was engaged on refinery construction work at Abadan. Here his first task was the erection of storage tanks on the island of Abadan and he relates how when the floods came up the tanks were washed away and they had to chase them for many miles out to sea.

After his marriage in 1912, he became Oilfields Manager to Messrs. Bewick Moeing & Co. at Maikop in South Russia. He remained in Russia until the revolution, when he returned home with his wife and young family. He relates how during the revolution all work on the oilfields ceased until a Local Soviet had been set up, and how he was elected a member of this Soviet by his Russian workmen. He did not, however, take an active part in this enterprise.

After his return to this country he obtained a commission in the Royal Naval Air Service. Nash always had a strong leaning towards the Senior Service and his family had many naval connections, one of his ancestors being writer on the "Victory" at the battle of Trafalgar. After the war Nash returned to his old firm but he left them in 1922 and joined the staff of the University as lecturer under Professor R. R. Thompson in the then newly formed Oil Engineering and Refining Department. In 1924 he succeeded Professor Thompson as Head of the Department.

Many notable researches have been carried out in the Department under Nash's direction. His early work was concerned with the cracking of petroleum oils. Following the conclusion of this work he devoted his time to dealing with the production of fuels and lubricants from coal, shale, and allied materials.

In 1924 he and his colleagues commenced work on the high-pressure hydrogenation of cellulose, lignin, and coal, some of the work being carried out in part collaboration with the Mining Research laboratory of the British Colliery Owners' Research Association. In 1926 published results of this work proved nickel oxide to be effective as a catalyst in the high-pressure hydrogenation of cellulose. This was the first conclusive work to be published in which the hydrogenation reaction was recognized as catalytic. This was confirmed later in the same year by a publication showing alumina

and nickel oxide to be catalysts in the high-pressure hydrogenation of lignin and cellulose.

In 1928, in collaboration with Dr. A. M. Stanley, Nash succeeded in showing that liquid hydrocarbon could be obtained from methane by thermal treatment, in this way confirming similar results published by Fischer earlier in the same year. A little later in 1928 Wheeler announced that he had succeeded in obtaining commercial yields of benzene from methane in 1926. Professor Nash and Dr. Stanley must be considered pioneers in this important work.

In 1929 Nash was publishing some of the first work on the knock ratings of pure hydrocarbons. This work attracted a good deal of attention and once again we find him to be one of the pioneers in a new field which subsequently led to vast and important developments. This line of work was continued in the Department for many years and noteworthy contributions on the knock rating of olefine and acetylene hydrocarbons were published in 1932 and 1933. In more recent years with the development of the diesel engine he commenced a similar project dealing with the diesel rating of pure hydrocarbons.

Nash was always interested in the production of fuels and lubricating oils from indigenous sources and research work carried out in his Department on these subjects continued from 1925 to 1940. The early work dealt with the production of fuel from carbon monoxide and hydrogen and was followed by work on the synthesis of lubricating oils by the polymerization of ethylene. This attracted much attention, especially the isolation of organo-metallic compounds of aluminium formed during the reaction by the aluminium halide condensing agent. Later researches in this field succeeded in preparing high-grade lubricants from chlorinated paraffin wax and benzene.

The work of the last five or six years in which Nash was engaged, has dealt largely with the fundamentals of solvent extraction and the results of this research have been widely applied by the petroleum industry in all parts of the world.

Nash possessed the gift of leadership, and in the many research investigations carried out in the Department under his direction was a source of inspiration to his junior colleagues and collaborators. Nearly 160 research papers were published by members of the Department during the period of his direction. Of these he was sole or senior author of more than eighty. In addition to his teaching and research he found time to produce several important text-books. The first of these was "The Principles and Practice of Lubrication" with Dr. A. R. Bowen, published by Chapman & Hall. The second was written in collaboration with Dr. D. A. Howes of the Anglo-Iranian Oil Company, entitled "The Principles of Motor Fuel Preparation and Application," and was also published by Chapman & Hall in 1935 in two volumes. This text-book had an immediate success and went into its second edition in 1938. It is an accepted authority on the manufacture of gasoline and has received very high praise from all petroleum technologists. Nash was one of the editors of the monumental "Science of Petroleum," published in 1937 by the Oxford University Press. In preparing this work he was associated with Dr. Dunstan of the Anglo-Iranian Oil Company, Sir Henry Tizard of

the Department of Scientific and Industrial Research, and with Dr. Brooks, the well-known American technologist. The exhaustive character of this publication and the care with which it was prepared was largely due to Nash's work as editor of contributions.

Professor Nash was an Original Member of the Institution of Petroleum Technologists in 1914, and later became a Life Member. He was elected a member of Council in 1925, a Vice-President in 1934, and became President in April 1939. In the first months of his Presidency he made arrangements for the summer meeting of the Institute in Birmingham, held in June 1939. In his dual capacity of President and the holder of a professorial chair at the University, he spared no effort to make this meeting both useful and pleasurable to visitors. The main topic of the meeting, "Fuels and Lubricants for Internal Combustion Engines," was one with which he was particularly qualified to deal and of the greatest importance to the Midlands motor industry.

Shortly after the outbreak of hostilities in September 1939 the Institute's offices at The Adelphi, London, were requisitioned at short notice by H.M. Government. Professor Nash immediately offered accommodation at the Department of Oil Engineering and Refining at Birmingham, a happy solution of the Institute's housing difficulties during the first two and a half years of war.

Nash was a member of the Institution of Chemical Engineers and a member of its Council since 1939. He was elected a full Member of the Institution of Mechanical Engineers in 1916. He was also a Fellow of the Institute of Fuel and of the Chemical Society.

By his death the Institute is bereft of a lovable personality and a man of sound judgment in counsel. To his widow and the members of his family, the sympathies of members of the Institute all over the world will go out.

DR. A. E. DUNSTAN writes:

Professor Nash followed in the footsteps of that great pioneer, the late Lord Cadman, who had founded the first school of petroleum technology in Great Britain under his charge as professor of mining. When Cadman left, the chair was divided and a separate professorship of oil technology was established, and in 1924 Nash was appointed to the post. A very substantial endowment of £125,000 had been raised by the great British oil companies, and Nash's first task was to erect a block of laboratories, offices, museum, and library to house his school. This was opened in 1926 and remains his chief monument.

During his whole career at Birmingham, Nash was responsible for a constant stream of scientific contributions to oil technology. He was a man of ideas and well able to stimulate his staff and students. With his ample background of first-hand experience in oilfields and refineries, he was well equipped to sense the relative importance of both practical and academic problems, and to direct a vigorous and progressive school of research, while in the course of his many visits to centres of oil activity in America, Europe, and the East he made innumerable contacts with the men on the spot, and thus realized the need for investigation on this or that project.

His researches and publications have been referred to in the account of his career given above. I should like to add a special tribute to his Presidential Address to the Institute of Petroleum on "Petroleum as a Raw Material." This showed a real insight into the ever-growing utilization of oil and its gaseous by-products as raw materials for chemical syntheses.

This brief note would be incomplete did I not pay a personal tribute to my old and valued friend and collaborator. Nash had a most lovable nature, and those of us who enjoyed his close friendship for many years must feel his passing acutely. Especially will he be missed by his old students who, working in all parts of the world, always kept in touch with him, and were always delighted to visit him on their return home.

PROFESSOR D. HANSON (Dean of the Faculty of Science in the University of Birmingham) writes:

For the past eighteen years Nash directed, with success and distinction, the Department of Petroleum Technology at the University. He possessed all the qualities required in such a post. Quick of thought, clear and logical in reasoning and expression, he was naturally a good lecturer; and when to these qualities are added a wide knowledge of men and life, a sound common sense, and an intense love of his work it is clear why he was a great professor.

Though he worked hard Nash was no recluse. When he played, he played as he worked, and enjoyed it as much. He was essentially a man's man and liked the open-air sports that men like—riding, hunting, shooting, fishing, and golf. And if through pressure of work he did not get as much relaxation as he would have liked, he made the quality of his enjoyment atone for any lack of quantity. He had travelled much and had a vast store of interesting knowledge, yarn, and anecdote—the result, no doubt, of an acute mind, good powers of observation, coupled with a retentive memory—which made him most interesting company.

Professor Nash was a world figure in his profession, and his influence was profound and world-wide. Such a man may cease to live, and we may mourn him; but his work goes on through his students in all parts of the world and his writings, and who shall say that he is dead?

DR. T. G. HUNTER writes:

During the eighteen years in which Professor Nash directed the Oil Engineering and Refining Department at Birmingham University, over one hundred students have graduated under his genial guidance. The sound training he has imparted together with the help he has so freely given with their careers, has contributed in no small measure to the success of these graduates in the Industry. Within the Department he expounded the principle that the success and welfare of the students was the first essential duty of the Staff, and both graduates and undergraduates requiring advice and assistance received this wholeheartedly from him. No trouble was too great for him in such matters and he leaves behind him an example and tradition which will endure.

In 1924 he began the first of a long series of noteworthy research in-

vestigations and he has, since then, built up and directed with distinction a vigorous and enterprising research School. He possessed the rare gift of inspiring enthusiasm in his collaborators and the present status of petroleum science owes much to his leadership and initiative.

In twelve years' intimate association with Professor Nash I have been privileged during this period to enjoy his friendship and I should like to take this opportunity of paying a personal and grateful tribute to him. Among his Staff at the Department and his old students his passing is deeply regretted. We have been deprived of a great and much-loved friend.

MR. R. R. DAVIDSON writes:

In Nash's younger days and particularly during that arduous period in his career from 1910 to 1914 there were few, if any, of his contemporaries who possessed to anything like the same degree his friendliness. What a medley of happy memories the mention of his name recalls! He was a great artist and his talent for entertaining found expression in song and story. His stories of the Fields were inspiring. They left us marvelling at his audacity and wondering what manner of man had come amongst us.

If ever the story of those early days in Persia receives the publicity it merits, Nash's name will figure prominently among the famous old-timers who laid the foundations of the Anglo-Persian.

DR. D. A. HOWES writes:

The memory of Nash will be cherished by all his students. To everyone of them he was well known, not only as a Professor and a teacher, but as a man whose sterling personal qualities claimed their highest esteem and regard. Their welfare was his constant concern and his interest in them continued long after they had left his care.

He maintained contact with all his students so generously and so naturally that some, recollecting years of unfailing friendship and practical help, must now find it hard to believe that they were perhaps officially in his charge for no more than a few months of post-graduate work. He was a great Professor and an almost prophetic leader, but to his students he will be remembered, not so much as the author of many research papers or even as one of the editors of the "Science of Petroleum," but as the conversationalist whose company was never dull, the man of infinite resource and sagacity, and most of all as the best of good friends whose advice and guidance could always be relied upon. He will be sadly missed by them all.

SIR WILLIAM BRAGG, O.M. (*Hon. Mem.*)

On 12th March last, at the flat above the Royal Institution in Albemarle Street in which Faraday lived and died, there passed away at the age of seventy-nine a man respected by men of science in every land, and loved by all those who had the privilege of his friendship.

He was brought up on a farm in Cumberland and attended the village school. Later he went to King William's College, in the Isle of Man, from which he won a scholarship to Trinity College, Cambridge, and was subsequently Third Wrangler in the Mathematical Tripos.

He was then appointed to the Chair of Mathematics and Physics at the University of Adelaide, where he remained for twenty-two years. It is a very surprising fact that he did no research work until he was over forty. He then became interested in radio-activity. In 1909 he returned to England to take the Cavendish Chair of Physics at Leeds, and six years later became Quain Professor of Physics at University College, London. In 1923 he became Director of the Royal Institution, and of the Davy-Faraday Research Laboratory. He never lost his love of the countryside, and for many years spent his week-ends in his house near Chiddingfold, where he made many friends. To help one of these he devised an apparatus which is now well known as the iron lung.

The work by which he will be best known is that of the development of the technique of elucidating the arrangement of the atoms in crystalline substances by means of the X-ray spectrometer, which he invented. With this, together with his son, now Sir Lawrence Bragg, Cavendish Professor of Physics at Cambridge, he carried out much brilliant work which in 1915 earned for father and son the coveted Nobel Prize.

The results of Bragg's work are very far-reaching. The method was eagerly adopted by numerous workers and resulted in the accumulation of an enormous amount of data which has thrown much light on the constitution of the most complex chemical bodies. As a result of this work, we now can understand why the diamond is hard, why certain minerals can soften water and be regenerated, why flannel shrinks when it is boiled in water, why certain chemical substances polymerize to plastics, and even an inkling of the chemical constitution of those very complex chemical molecules, the proteins, on which life itself depends.

His admiration for his great predecessor, Michael Faraday, amounted almost to worship. He took a great delight in repeating the early experiments at his lectures, using the actual apparatus which Faraday had made. He studied Faraday's works from his written notes, which have all been preserved and recently published, and he took a great delight in understanding the workings of that great man's mind, and explaining them to his interested audiences in the many lectures which he gave.

In the best sense of the word he was a deeply religious man. In his Riddel memorial lecture, delivered in Durham in 1941, he pointed out that "each man can try the Christian way and discover for himself and acquire his own convictions. He tests his faith. He has ever in front of him the hope that he will by doing his service play his part in binding the community together. That is his hope. As to the actual mode of the experiment, I will say nothing. We know it well already: it has been

enshrined in a thousand testimonies; it is all included in the lovely words of St. Paul, simple though they are: 'And the greatest of these is charity.'"

J. KEWLEY.

NORMAN MITCHELL.

IT is with regret that we received the announcement of the death of Norman Mitchell on 10th May. Mr. Mitchell was in charge of the Asiatic Petroleum Company's Engine Fuel Department, and had been associated with the Company for a period of twenty-one years. Prior to this he served during the last war with the Royal Naval Air Service and the Royal Naval Volunteer Reserve. He served on the Institute's Knock Rating Committee, and also represented the Institute on various occasions in America where he joined in the work of the C.F.R. Committee. In this he was singularly successful, as his personality made him extremely welcome to all his friends in America whenever he visited them. He made frequent visits there both in connection with his work on the C.F.R. Committee and as a foreign member of the S.A.E. He had been a Member of the Institute since 1936.

His work took him to many parts of the world where his staff carried on the work of testing I.C. engine fuels and advising the sales areas of the company with which he was associated. It is of interest to record that Mitchell was very closely connected with much of the early work on fuels done by Messrs. Richardo & Co., and continued this association until quite recently.

To those who knew him intimately it is not surprising that Mitchell had close friends in every part of the globe. A man of great charm and with a genuine friendly spirit such as his could not help making friends wherever he went. Perhaps one of his most engaging features was his extreme simplicity. He managed to retain a very young attitude of mind throughout his life, and had a keen sense of humour which one might perhaps associate with his Irish origin, for he was born in Ireland and lived there in the early part of his life.

Mr. Mitchell was 55 years of age and leaves a widow and one son, who has chosen the Navy as a career, and is now making rapid strides in his profession.

R. I. LEWIS.

A TECHNICAL STUDY OF TRANSVAAL TORBANITE.

By S. L. Neppe, B.Sc. (Eng.), A.I.C., A.M.Inst.Pet.

The following results are an Addendum to the author's previous Paper on this subject (*J. Inst. Pet.*, February 1941, **27**, No. 208, 31).

SECTION B.—EXPERIMENTAL.

1. Physical Examination.

(f) *Pressure Extraction Tests on Transvaal Torbanite.*

In order to ascertain the optimum conditions for pressure extraction of torbanite, it was decided in different tests to vary temperature, pressure, size of material extracted, and time of heating.

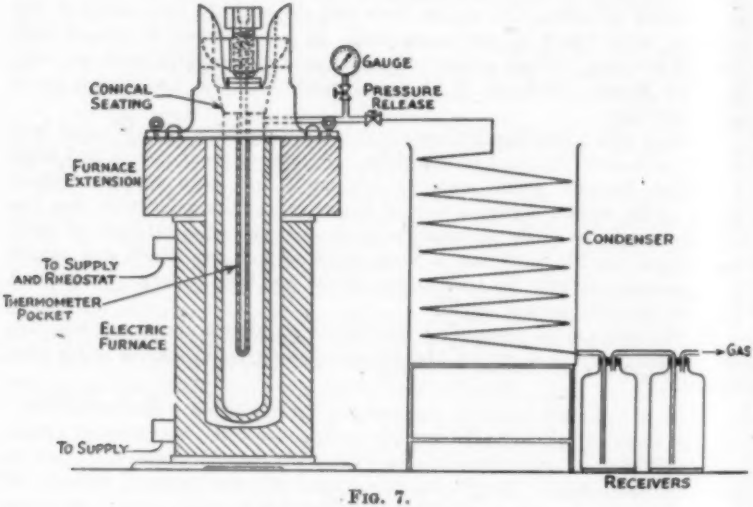


Fig. 7.

5-litre steel autoclave.

Owing to lack of suitable facilities at the time this particular work was carried out, the solvent used in the following series of tests was Shell Petrol, although pure dry benzene would undoubtedly have been preferable and more advantageous.

The apparatus used for these experiments was a 5-litre steel autoclave or high-pressure bomb, shown in Fig. 7. Heating was carried out by an electric muffle (Wild Barfield type, 200–220 v., 3020 watts), and the furnace temperature could be controlled fairly accurately by an external

resistance of 16·5 ohms carrying 11 amps. The temperature during a test was recorded by inserting a thermocouple or thermometer into the central pocket of the bomb.

A wire gauze cage was specially constructed to hold the ground torbanite, and fitted inside the bomb. This arrangement was found to be most convenient in facilitating fairly complete removal of the solid matter from the bomb at the completion of an extraction experiment.

A particularly rich deposit of torbanite (Sample No. 4c) was purposely selected for these experiments.

A blank determination was first carried out to study the effect, if any, of heating the torbanite alone in the autoclave for a period of 2 hours at 250° C. Very little decomposition of the torbanite, beyond a very slight residual pressure in the bomb after cooling, was observed. Proximate analyses of the material before and after the experiment showed practically the same results.

All tests were carried out on 400 gm. of torbanite with 1500 ml. of solvent. Unfortunately, no arrangements could be made for carrying out the experiments in an inert atmosphere, which would have been preferable for this type of work. The volume of air present in the apparatus at the beginning of each extraction was 2800 c.c. It is probable that besides having an oxidizing effect on the petrol, the air may have retarded the actual solvent action of the torbanite by the petrol.

In this work, only one extraction was carried out for each particular test, although successive extractions would undoubtedly have given increased yields.

After extraction had been maintained under certain conditions of pressure and temperature for a definite period of time, the current was switched off, and the bomb allowed to cool slowly in the furnace, generally overnight.

Any residual pressure in the autoclave due to gas formation was first released slowly through the valve, and the gas passed through a meter at atmospheric pressure and sampled for analysis.

The bomb was then opened up, and the gauze cage, containing the bulk of the extracted torbanite, removed. The solution and remainder of the material were then tipped out and the bulk of the solution separated off by filtration. The combined extracted material at this stage, however, contained a high proportion of the solution by absorption (*e.g.*, in Test 2, after filtration, 36 per cent. of the total extract remained behind with the extracted torbanite). It was thus necessary to complete the extraction in every case under atmospheric conditions to remove all the extract adhering mechanically to the torbanite, this process being continued until the solvent in the flask containing the torbanite was only pale in colour.

The solutions obtained from the autoclave by filtration and from final extraction at atmospheric pressure were then combined, and the petrol solvent distilled off. A proof that no heavy petrol remained behind in the extract was that for all the tests the combined weight of torbanite residue and extract totalled the original weight to within 0·5 per cent. maximum and 0·2 per cent. average.

In all cases the solutions from extraction were orange-coloured with a green fluorescence, and the final residue in the distillation flask—*i.e.*, the

TABLE IVA.

Pressure Extraction of Transvaal Torbanite.

Solvent used: Shell Petrol.
Sample No. 4c (Prox. Analysis: Vols. 61·39, Ash 25·64, Fix. Carb. 12·97, Carb.–Ash Ratio 0·50. Assay Value 104 gals. per ton, *i.e.*, 45·7% oil).

Test No.:	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Size of material (I.M.M. mesh)	−20	−20	−20	−20	−20	−20	−20	−20	−60	−60	−60	−60
Max. temp. (° C.)	—	220	245	240	260	270	310	320	295	320	325	335
Max. gauge press. (lb. per sq. inch)	Atmospheric	270	275	340	440	390	640	800	640	840	1,050	1,250
Total time of heating (hours)	8	8	2·5	7	8	16	16	4	16	8	8	8
Total extract (wt. %)	0·58	1·78	3·92	2·0	1·78	3·1	6·25	4·75	17·5	19·65	15·0	17·7
Total extract on D.A.F. basis (wt. %)	0·78	2·40	5·27	2·69	2·40	4·17	8·41	6·39	23·54	26·42	20·20	23·80
Total extract as % of retorting yield	1·3	3·9	8·6	4·4	3·9	6·8	13·7	10·4	38·4	43·0	32·8	38·8
Specific gravity of extract (at 15·5° C.)	—	—	—	—	—	—	—	—	0·935	0·927	0·910	0·922
Gas of evolution (cu. ft. per short ton at N.T.P.)	—	—	—	—	—	—	109	78	422	563	767	1,057
Composition of gas of evolution (vol. %): $H_2S + CO_2$	—	—	—	—	—	—	5·2	8·2	8·1	13·1	15·9	13·3
Unsaturates C_nH_m:	—	—	—	—	—	—	13·6	22·2	6·6	5·6	11·4	9·2
O_2	—	—	—	—	—	—	2·1	1·1	1·5	2·5	2·6	2·9
CO	—	—	—	—	—	—	16·0	10·1	11·2	11·3	1·0	0·3
H_2	—	—	—	—	—	—	14·5	10·1	2·1	9·6	7·3	6·3
N_2	—	—	—	—	—	—	48·6	48·3	49·8	32·6	30·3	32·8
Saturates C_nH_y	—	—	—	—	—	—	Nil	Nil	20·7	25·3	31·5	35·8
Value of x in C_nH_x	—	—	—	—	—	—	3·05	4·51	1·9	4·1	3·1	3·2
Carb.–Ash ratio of residue	—	—	0·53	0·55	—	—	—	—	0·56	0·55	0·54	0·53

extract obtained from torbanite at high pressure but relatively low temperature—was a moderately viscous black bituminous oil, free from light distillate. Beyond the fact that the specific gravities of the extracts in Tests 9–12 (Table IVA) have been recorded, no further information was obtained about the nature of the extracts, owing to lack of available facilities.

Test No. 1, on 400 gm. of torbanite dried previously at 120° C., was carried out under atmospheric conditions alone for comparative purposes.

As recommended by Bone [1] and his associates in their classic researches on coal. Tests 1–8 were carried out on —20 mesh material dried at 120° C., but, owing to the relatively unsatisfactory yields, it was decided to use a finer-grade material (— 60 mesh) for subsequent tests 9–12. This size corresponded more closely to the size of the kerogen gels determined previously.

The considerable improvement in yield shown, for example, by Test 9 over Test 7 by using material of increased fineness, is marked. Conditions of maximum pressure and time of heating in these two tests were identical, and, if anything, the higher temperature of Test 7 should have been conducive to a higher percentage of extraction. These tests emphasize the importance, stressed earlier, of using material the size of kerogen gels for recovering the oily portion of the mineral.

The general effect of maximum temperature, pressure, and time of heating is immediately apparent from the table, although Test 3 gave a yield slightly higher than would be expected from the other tests. Similarly, Test 10 appears to give a higher yield than Tests 11 and 12, although the latter were carried out under more strenuous conditions. This may be explained by the enormous difficulty generally experienced in this type of work for obtaining exactly concordant results under comparable working conditions.

The tests carried out for 16 hours were all 2-day runs of 8 hours each. In Tests 10, 11, and 12 the maximum temperature and pressure conditions were maintained for 3 hours, the maximum conditions in Test 9, however, being maintained for about 4 hours on each day.

The effect of time can be seen by a comparison, for example, of Tests 5 and 6 or Tests 7 and 8, which show that although Test 8 was carried out at a higher pressure and temperature than 7, a lower extract was obtained and also less total gas, indicating that insufficient time was given for 8 to reach the same state of completion as 7.

With increasing temperature and pressure there is apparently increasing decomposition of the torbanite, as shown also by the increasing yields of gas.

Since the ratio of nitrogen to total oxygen (combined and uncombined) in the residual gas after extraction was different from that in the original air, part of this gas must have been due to thermal decomposition of the torbanite, but since the total quantity of gas evolved including petrol vapour was relatively small—compare the yield on low-temperature carbonization tests described in the original paper—it can be concluded that the actual pressure thermal decomposition of torbanite is negligible below 300° C.

The gas analyses reported in Table IVA are not exactly as determined, as the latter included the air originally present in the bomb (2800 c.c.),

the oxygen content being assumed to be converted into carbon dioxide by oxidation of the petrol. An allowance has therefore been made for such air, the values given (in cu. ft. per ton at N.T.P.) being thus due only to gas of formation from torbanite decomposition, together with vapours derived from the petrol solvent.

The presence of the large quantity of saturated and unsaturated hydrocarbons in the residual gas is indicative of the high proportion of petrol vaporized during extraction. An interesting feature is the high proportion of nitrogen evolved under the more heavy conditions of temperature and pressure; this can come only from the decomposition of the torbanite.

Reference.

[1] Bone, Pearson, and Quarendon, "Researches on the Chemistry of Coal. Part III. The Extraction of Coals by Benzene under Pressure," *Proc. Roy. Soc.*, 1924, **105**, A, 68.

NOTE ON THE SEALING EFFECT OF FAULT SURFACES.*

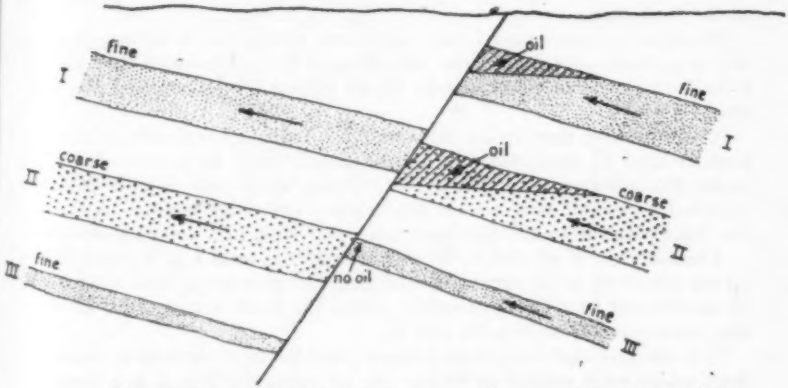
By G. Stewart Taitt, A.M.I.Mech.E., F.G.S. (Fellow).†

A paper on the above subject was read by the author at a meeting of the Trinidad Branch on 29th January, 1941, and was followed by a discussion.

The following is a summary of the most important points in the paper.

The effect of subsidiary faulting in controlling oil accumulation conditions in local tectonic blocks within a structural unit is now generally recognized.

It has only recently become apparent, however, that the separation effected by such faults is not always maintained in the later stages of exploitation, and that migration across the fault surfaces may bring about complicated producing conditions calling for the closest study if water-flooding or unsatisfactory drainage is to be avoided.



Oil accumulation at contact of coarse and fine sands on opposite sides of fault plane

Fig. 1.

It is difficult to say whether the normal condition is represented by faults which provide permanent control, *e.g.* by the formation of an impervious zone due to the presence of plastic or pulverised material on the fault surface, or by faults in which the control is unstable and liable to

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† United British Oilfields of Trinidad, Ltd.

break down as a result of artificial changes of pressure on opposite sides of the fault.

In the latter case, which presumably would be more likely to occur, for example, in a series consisting of sands with relatively few clay breaks, the fault surface could be regarded ideally as having no thickness, being simply the contact surface of the formations on the opposite sides.

Control of accumulation would then be simply a question of retention of oil at the interfaces of sands of different texture, as postulated in the published works of Dr. Versluys,[1, 2] Professor Illing,[3, 4] and others, depending only on the "filtration pressure" resulting from the intermolecular forces between the oil and the circulating water.

An example of this condition is given in Fig. 1.

Professor Illing has shown that the filtration pressure may be of quite a low order,[4] and that if the pressure differential between the coarse and fine sand is raised sufficiently, the seal may be broken down and the oil can then migrate into the finer sand.

In the hypothetical example shown in Fig. 1, the oil is assumed to have been brought to the fault plane by circulation of the underground waters across it in the direction shown by the arrows. In the upthrown block sand I is shown as having oil trapped in fine sand in contact with the still finer shale, sand II has oil trapped at the contact of coarse sand against fine sand, while the fine-grained sand III is water-bearing as the migrating oil has escaped into the coarser sand with which it is in contact at the fault-plane.

The shale opposite sand I may have been compacted to form a practically impervious seal, but in the case of sand II it is assumed that the oil is held at the fault-plane simply by its reluctance to entering the finer sand.

It will be seen that under the above conditions exploitation of the oil-pool in sand II may result in a considerable drop in pressure, so that, under the influence of its hydrostatic head, water can migrate into the depleted zone, not only within the coarse sand (edge water), but across the fault plane from the fine sand into the coarse in a *down-tip* direction.

Alternatively, if oil should be withdrawn from sand I at a point higher on the structure in the downthrown block, the pressure in that sand might be so reduced that the differential across the fault would cause oil from the coarse sand II to migrate into it.

It is obvious that complicated water troubles may occur in a producing field where such conditions exist. As an example, Fig. 2 is a diagrammatic representation of an actual case well substantiated by field evidence.

It is not known whether such conditions of water-flooding across fault-planes represent a very rare occurrence, or whether they are really more common but have usually escaped detection. It is evident, however, that when dealing with fields in which faulting plays an important part in control of accumulation, the possibility of fluid migration across the faults as a result of pressure changes should receive attention.

The author's thanks are due to the United British Oilfields of Trinidad, Ltd., for permission to publish this paper.

Flooding at top of structure due to water migration across fault plane.

FIG. 2.

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[1] Versluys, J., "Factors Involved in Segregation of Oil and Gas from Subterranean Water," *Bull. Amer. Ass. Petrol. Geol.*, 1932, Vol. 16, No. 9.
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[3] Illing, V. C., "The Migration of Oil and Natural Gas," *J. Inst. Petrol. Tech.*, 1933, No. 19, p. 229.
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Point Fortin,
7th April, 1942.

REID VAPOUR PRESSURE OF ALCOHOL BLENDS.*

By S. J. W. Pleeth, B.Sc. (Member).†

In the standard method for the determination of the Vapour Pressure of Motor Spirits by the Reid method (I.P. Serial No. G37, A.S.T.M. Serial No. D323–32T) certain precautions and modifications are necessary when examining blends containing ethyl alcohol. The present note may be found useful to new workers in this field, in consequence of the growing importance of alcohol blends.

The first precaution is obvious: the sample cannot be obtained by water displacement, and the gasoline chamber may be filled either by direct immersion into the sample to be tested, or by pouring, if the temperature be low enough, or by siphon, the normal method for laboratory use.

The second precaution is less obvious, and may easily be overlooked. The standard method states that the air-chamber shall be rinsed with water before use and the temperature of the air within the chamber taken. When now the spirit is introduced, the bomb assembled, and the whole immersed in a bath at the standard temperature of 100° F., the rise in pressure is due to the increase in vapour pressure of the gasoline and the water (considered as saturated by providing excess) and by the normal pressure increase of air. To obtain the required vapour pressure of the gasoline, a correction is applied to the gauge reading corresponding to the two other factors introduced. This is given by the standard correction

$$\frac{(P_a - P_t)(t - 100)}{460 + t} - (P_{100} - P_t)$$

where t = initial air-chamber temperature, ° F.
P_t = vapour pressure of water in lb. per sq. in. at t° F.
P_{100} = vapour pressure of water in lb. per sq. in. at 100° F.
P_a = normal barometric pressure in lb. per sq. in.

In the author's laboratory it has been observed that the amount of water left in the bomb after rinsing is usually sufficient to cause separation of the alcohol blend into the two phases: aqueous alcohol and petroleum spirit. The standard correction no longer applies, for there is no free water in the bomb. In any case, the recorded vapour pressure is erroneous, for, by Raoult's Law, the total vapour pressure of immiscible liquids is the sum of their partial pressures, and would lie between the values for aqueous alcohol and petroleum spirit; whereas it is well known that alcohol and petroleum hydrocarbons give azeotropes of higher vapour pressure than either of their constituents.

We have therefore taken the liberty of modifying the standard method

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when testing alcohol blends by using a dry bomb, by rinsing with alcohol or acetone and blowing with air; an initial air temperature is obtained, the gasoline chamber filled by siphoning, and the method proceeds as before.

The correction factor to be applied in this case ignores the water-vapour factor, as we assume that the pressure of the water vapour in the air at the commencement of the test increases with temperature to the same extent as does the air. The factor now becomes

$$\frac{P_a(t - 100)}{460 + t}$$

or to a close approximation

$$0{\cdot}03(t - 100) \text{ lb.}$$

Using this method, the true vapour pressure of alcohol blends is obtained, and the phenomenon of the enhanced vapour pressure of azeotropes of ethyl alcohol, benzole, and petroleum spirit readily observed.

One final point: it has often been stated, especially in the American journals, that alcohol motor-spirit blends cause greater vapour locking in an automobile than normal petroleum-spirit fuels of the same Reid Vapour Pressure. We have never found this difficulty to arise in practice on English roads, and this may be due to the less severe temperature conditions that apply here. An alternative explanation might be obtained in the light of the present paper.

Failure to observe the precautions outlined above would result in a depreciation of vapour pressure of alcohol motor spirits of several lb. per sq. in. Thus an alcohol motor spirit of true Reid Vapour Pressure of 10 lb. might be recorded as only 8 lb. This fuel would then be tested in an automobile against a petroleum motor spirit of only 8 lb. vapour pressure, and would, of course, reveal an enhanced tendency to vapour lock. Had it been tested against its equivalent—a petroleum motor spirit of 10 lb. vapour pressure—the opposite result would have been recorded, as our own road tests have shown, a result that confirms theoretical considerations.